**CIS 350 – INFRASTRUCTURE TECHNOLOGIES**

**HOMEWORK #5 (Chapters 9, 10 & 11) – 90 points**



Student name(s): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(2 students maximum)

Work this homework and submit the solution by e-mail only to [jozef.zurada@louisville.edu](mailto:jozef.zurada@louisville.edu). Do not bring it to my office. Please write/mark your answers on the following 5 pages.

**Part I. Work the following problems in the space provided below. You must show your calculations. Points will be deducted if you do not. (Each exercise 1 through 4 is worth 10 points for the total of 40 points). You must put your answers on these sheets.**

**Exercise 1**

A hard disk contains 22 platters. The data is recorded on both surfaces of each platter. Each surface has 5000 tracks. A track contains 2,000 sectors and each sector stores 2,048 bytes.

1. What is the capacity (expressed in Megabytes and Gigabytes) of one cylinder?
2. What is the capacity (expressed in Megabytes and Gigabytes) of the entire hard disk?

You must show your calculations.



**Exercise 2**

The hard disk from Exercise 1 above has the average seek time of 7 milliseconds [ms]. The disk revolves with the speed of 9,000 revolutions per minute.

1. Compute the average rotational delay (latency time).
2. Compute the transfer time for 1,600 sectors.
3. Compute the total disk access time which is the sum of the three times: the average seek time, the average rotational delay (latency time), and the transfer time for 1,600 sectors.

You must show your calculations. Express all the times in milliseconds [ms].

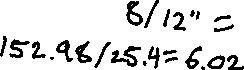


**Exercise 3**

A 1600-pixel by 900-pixel display is generated on a 12-inch diagonal monitor.

1. How many pixels/dots per inch are displayed on this monitor?
2. How many pixels/dots per millimeter [mm] are displayed on this monitor?
3. What is the size of an individual pixel in [mm]?

Note that 1"=25.4 mm. Approach: Use the Pythagoras theorem to calculate the number of pixels on the 12" diagonal of the monitor for a 1600-pixel by 900-pixel display.



**Exercise 4**

Assume that a PCI-Express bus consists of 32 lanes. Each lane is capable of a maximum data rate of 300 MB per second. Lanes are allocated to a device 1, 2, 4, 8, 16, or 32 lanes at a time. Assume that the PCI-Express bus is connected to a high definition video card that is supporting a 1600 × 900 true color (3 bytes per pixel) progressive scan monitor with a refresh rate of 180 frames per second. How many lanes will this video card require to support the monitor at full capability? You must show your calculations.



**Part II. Multiple choice questions. Mark the answers on these sheets** (50 points). You will need to read chapters 9-11 from the textbook to answer some of these questions. The lecture notes alone will not be sufficient.

1) An important difference between the I/O requirements of keyboards and disk drives is that

a) keyboard input is fast while disk drives are slow.

b) keyboards require constant monitoring, while disk drives do not.

c) disk drives have I/O controllers and keyboards do not have I/O controllers.

d) disk data is always transferred in blocks, never as individual bytes as with the keyboard.



2) The method used to communicate events that need special attention to the CPU are known as

a) interrupts. b) I/O controllers. c) programmed I/O. d) device controllers.



3) Computers provide interrupt capability by providing one or more special control lines to the central processor known as

a) fault lines. b) address lines. c) interrupt lines. d) instruction lines.



4) When an interrupt causes temporary suspension of the program in progress, all the pertinent information about the program being suspended, including the location of the last instruction executed, and the values of data in various registers are stored in an area of memory known as the

a) register dump block. b) memory dump block.

c) program method block. d) process control block.



5) Since many interrupts exist to support I/O devices, most of the interrupt handling programs are also known as

a) device drivers. b) device handlers. c) peripheral handlers. d) peripheral controllers.



6) Which of the following is not a function of how interrupts are used?

a) A completion signal b) An abnormal event indicator

c) A means of allocating CPU time d) A way of buffering large amounts of data



7) External events like keyboard input, mouse clicks, printer “out of paper” messages, and power failures are handled by

a) interrupts. b) device handlers. c) peripheral controllers. d) suspension subprograms.



8) Events related to problems or special conditions within the computer system itself, like divide by zero, or attempting to execute a nonexistent op code, are called

a) irregular events. b) unusual events. c) abnormal events. d) anomalous events.



9) Instructions that are intended for use by an operating system program, but not by an application program, are called

a) control instructions b) limited instructions

c) prevalent instructions d) privileged instructions



10) The mnemonic for the x86 architecture instruction that simulates an interrupt is

a) SVC. b) INT. c) JMP. d) GTO.



11) When the device generating the interrupt request identifies its address as part of the interrupt, it is called

a) polling interrupt. b) discrete interrupt. c) vectored interrupt. d) monitoring interrupt.



12) Power failures, internal time-sensitive events, or external events that are time sensitive will trigger interrupts that are

a) low priority events. b) high priority events.



c) dependent on the device generating the interrupt.

d) measured for time-to-complete and scheduled accordingly.

13) Interrupts that can never be temporarily disabled by program instructions are called

a) invariable. b) unchangeable. c) nonmaskable. d) non-transferable.



14) An I/O technique that transfers block data directly between the I/O controller and computer memory, is called

a) direct block access. b) direct RAM access. c) direct block transfers. d) direct memory access.



15) The incompatibilities in speed between the various devices and the CPU make I/O synchronization difficult, especially if there are multiple devices attempting to do I/O at the same time. To handle these problems data is usually stored

a) in a buffer. b) on the network. c) on the disk drive. d) in external storage.



16) An I/O controller that is designed to control hard disks is called a

a) disk handler. b) disk controller. c) disk coordinator. d) disk interrupt handler.



17) Storage not immediately available to the CPU is referred to as

a) cloud storage. b) off-line storage. c) network storage. d) secondary storage.



18) In technical specifications for flash memory, the read/write block is called a

a) page. b) lump. c) chunk. d) paragraph.



19) With the hard drive read/write head in a fixed position, it traces out a circle on the disk surface as the disk rotates; this circle is known as a

a) page. b) block. c) track. d) cluster.



20) When a disk drive has multiple platters, the heads on each surface all line up. The set of tracks for all the surfaces form a geometric shape similar to a

a) bottle. b) ellipse. c) sphere. d) cylinder.



21) In a disk drive where the drive motor turns at constant angular velocity, which is true of the linear velocity?

a) inner tracks move the fastest b) outer tracks move the fastest



c) middle tracks move the fastest d) all tracks move at the same speed

22) Once the hard-disk read/write head is located over the desired track, the read/write operation must wait for the disk to rotate to the beginning of the correct sector. This time is called

a) seek time. b) arrival time. c) transfer time. d) rotational latency time.



23) What system performance attribute is most increased by using a redundant array of independent disks (RAID)?

a) System reliability b) System accessibility c) System serviceability d) System maintainability



24) A special fault-tolerant computer system uses an array of 3 disks. The following logic is used to detect errors: If the data from all three disks is identical, then it is safe to assume that the integrity of the data is acceptable. If the data from one disk differs from the other two, then accept the data where both match and flag the other as an error. This logic is known as

a) disk logic. b) majority logic. c) difference logic. d) greater-part logic.



25) A mirrored array requires a minimum of \_\_\_\_\_\_\_\_\_ disk drives.

a) two b) three c) four d) five



26) Displays that use 256 (Red) × 256 (Green) × 256 (Blue) different colors on the screen is sometimes described as a

a) true color system. b) virtual color system. c) ultra high density system. d) high density color system.



27) A proprietary standard, developed by Microsoft to render 2-D and 3-D objects is known as

a) OpenGL. b) DirectX. c) ActiveX. d) OpenSource.



28) A key to the efficient operation of a GPU is the ability to dispatch instructions to the CPU cores in rapid succession, a process commonly called

a) flowing. b) cramming. c) smoothing. d) streaming.



29) With the exception of the Cell Engine, current GPUs are generally based on maximizing the number of operations that can take place at the same time, or \_\_\_\_\_\_\_\_\_\_\_\_\_\_.

a) serialization b) concurrency c) parallelization d) synchronization



30) Which display technology consists of a thin display panel that contains red, green, and blue LEDs for each pixel with transistors for each LED that generate electrical current to light the LED?

a) CRT b) LCD c) FED d) OLED



31) Which of the following printing technologies boils ink in a nozzle to spray a tiny droplet onto the paper?

a) LED printers b) Laser printers c) Ink-jet printers d) Impact printers



32) With voice input data, the translation process requires the conversion of voice data into sound patterns known as

a) phonemes. b) sound bytes. c) sound slices. d) part-of-speech.



33) Protocols that describe a computer’s communication with the physical layer network are called

a) LAN access control protocols b) shared access control protocols

c) medium access control protocols d) medium admission control protocols



34) In most computer systems, the CPU, memory, and other major components are mounted to wiring on a printed circuit board known as a(n)

a) circuit plane b) motherboard c) adapter board d) peripheral board



35) Considering the computer system as a whole allows further advances in performance, which result from system integration. This is known as

a) utility. b) synergy. c) harmony. d) integrated cooperative action.



36) The CPU and memory are interconnected through a memory bridge sometimes called the

a) I/O Bridge. b) southbridge. c) northbridge. d) Interconnect Bridge.



37) The IEEE 1394 bus is sometimes referred to as

a) USB. b) Firewire. c) DisplayPort. d) Thunderbolt.



38) USB uses a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ connection system, in which hubs are used to provide multiple connection points for I/O devices.

a) sequential b) master-slave c) peer-to-peer d) hierarchical



39) SATA stands for Serial Advanced Technology Attachment; it replaces an older standard, IDE (Integrated Drive Electronics), and is used primarily as an interface for

a) printers. b) network communications.

c) high resolution video displays. d) magnetic and optical disk storage devices.



40) The USB protocol allows packets to be scheduled for delivery at regular time intervals. This technique is known as

a) synchronous data transfer. b) asynchronous data transfer.

c) isochronous data transfer. d) bisynchronous data transfer.



41) Thunderbolt connections can be made using either copper or fiber optic cable. The optic cable will work over distances of up to \_\_\_\_\_\_ meters.

a) 10 b) 50 c) 100 d) 1,000



42) The input-output architecture based on separate I/O processors and used on IBM mainframes is known as a(n)

a) SCSI subsystem. b) channel subsystem.



c) subroutine subsystem. d) embedded I/O CPU subsystem.

43) The primary purpose of channel programs is to transfer data using DMA between

a) memory and CPU. b) memory and the NIC.

c) memory and RAID arrays. d) an I/O device and memory.



44) The method of connecting loosely coupled computers together with a dedicated communication channel or link that passes messages between machines is called

a) binding. b) bunching. c) grouping. d) clustering.



45) In a cluster of loosely coupled computers, each computer in the cluster is called a

a) hub. b) node. c) server. d) member.



46) Which of the following is *not* a reason to create clusters of computers?

a) load balancing b) fault tolerance c) high availability d) increased security



47) There are two primary models used for clustering, the \_\_\_\_\_\_\_\_\_ model, and the \_\_\_\_\_\_\_\_\_ model.

a) share-CPU, share-disk b) share-CPU, share network

c) share-nothing, share-CPU d) shared-nothing, shared-disk



48) Beowulf clusters are simple, highly configurable clusters designed to provide high performance at low cost. Beowulf clusters consist of multiple computers connected together by a dedicated, private

a) VPN. b) Ethernet. c) Internet connection. d) fiber channel protocols.



49) Blade servers are computers mounted on a board similar to a motherboard that can be plugged into connectors on a rack. The blades themselves are

a) built from proprietary hardware. b) built from IBM proprietary hardware.

c) built from standard off-the-shelf parts.



d) built from proprietary hardware, but commercial operating systems.

50) Systems that use the spare processing capacity of computers connected to a network is called

a) grid computing. b) supercomputing. c) cluster computing. d) parallel computing.

